

CHAPTER 8 REVIEW*Chemical Equations and Reactions***SECTION 1****SHORT ANSWER** Answer the following questions in the space provided.

1. Match the symbol on the left with its appropriate description on the right.

$\underline{\quad d \quad} \xrightarrow{\Delta}$	(a) A precipitate forms.
$\underline{\quad a \quad} \downarrow$	(b) A gas forms.
$\underline{\quad b \quad} \uparrow$	(c) A reversible reaction occurs.
$\underline{\quad f \quad} (l)$	(d) Heat is applied to the reactants.
$\underline{\quad e \quad} (aq)$	(e) A chemical is dissolved in water.
$\underline{\quad c \quad} \rightleftharpoons$	(f) A chemical is in the liquid state.

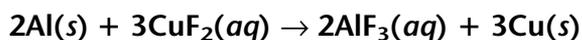
2. Finish balancing the following equation:



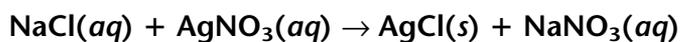
3. In each of the following formulas, write the total number of atoms present.

<u>12 atoms</u>	a. 4SO_2
<u>16 atoms</u>	b. 8O_2
<u>51 atoms</u>	c. $3\text{Al}_2(\text{SO}_4)_3$
<u>3×10^{24} atoms</u>	d. $6 \times 10^{23} \text{HNO}_3$

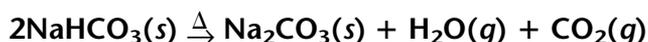
4. Convert the following word equation into a balanced chemical equation:
-
- aluminum metal + copper(II) fluoride
- \rightarrow
- aluminum fluoride + copper metal



5. One way to test the salinity of a water sample is to add a few drops of silver nitrate solution with a known concentration. As the solutions of sodium chloride and silver nitrate mix, a precipitate of silver chloride forms, and sodium nitrate is left in solution. Translate these sentences into a balanced chemical equation.



6. a. Balance the following equation:
- $\text{NaHCO}_3(s) \xrightarrow{\Delta} \text{Na}_2\text{CO}_3(s) + \text{H}_2\text{O}(g) + \text{CO}_2(g)$

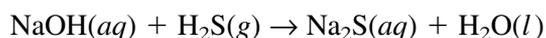


SECTION 1 continued

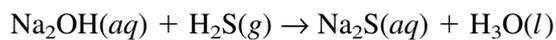
- b. Translate the chemical equation in part a into a sentence.

When solid sodium hydrogen carbonate (bicarbonate) is heated, it decomposes into solid sodium carbonate while releasing carbon dioxide gas and water vapor.

7. The poisonous gas hydrogen sulfide, H_2S , can be neutralized with a base such as sodium hydroxide, NaOH . The unbalanced equation for this reaction follows:



A student who was asked to balance this equation wrote the following:



Is this equation balanced? Is it correct? Explain why or why not, and supply the correct balanced equation if necessary.

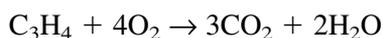
It is balanced but incorrect. In two of the formulas the subscripts were changed, which changed the compounds involved. Water is not H_3O , and sodium hydroxide is not Na_2OH . The correct balanced equation is $2\text{NaOH} + \text{H}_2\text{S} \rightarrow \text{Na}_2\text{S} + 2\text{H}_2\text{O}$.

PROBLEM Write the answer on the line to the left. Show all your work in the space provided.

8. Recall that coefficients in a balanced chemical equation give relative amounts of moles as well as numbers of molecules.

30 mol

- a. Calculate the number of moles of CO_2 that form if 10 mol of C_3H_4 react according to the following balanced equation:

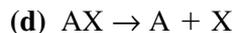


40 mol

- b. Calculate the number of moles of O_2 that are consumed.

CHAPTER 8 REVIEW*Chemical Equations and Reactions***SECTION 2****SHORT ANSWER** Answer the following questions in the space provided.

1. Match the equation type on the left to its representation on the right.

 c synthesis d decomposition b single-displacement a double-displacement

- 2.
- c
- In the reaction described by the equation
- $2Al(s) + 3Fe(NO_3)_2(aq) \rightarrow 3Fe(s) + 2Al(NO_3)_3(aq)$
- , iron has been replaced by

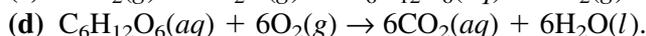
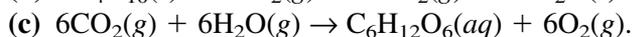
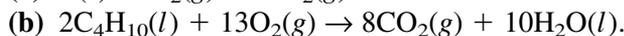
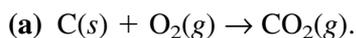
(a) nitrate.

(c) aluminum.

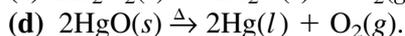
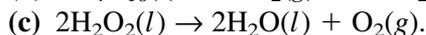
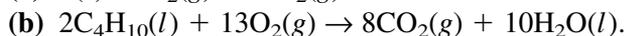
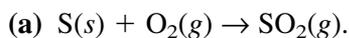
(b) water.

(d) nitrogen.

- 3.
- a
- Of the following chemical equations, the only reaction that is both synthesis and combustion is



- 4.
- b
- Of the following chemical equations, the only reaction that is both combustion and decomposition is



5. Identify the products when the following substances decompose:

 its separate elements

a. a binary compound

 metal oxide + water

b. most metal hydroxides

 metal oxide + carbon dioxide

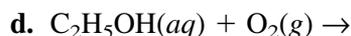
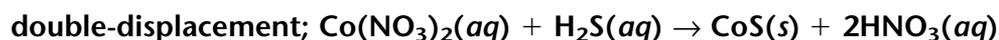
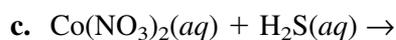
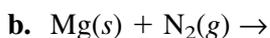
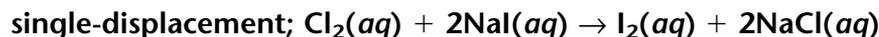
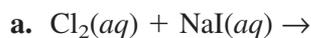
c. a metal carbonate

 water + sulfur dioxide d. the acid H_2SO_3

6. The complete combustion of a hydrocarbon in excess oxygen yields the products
- CO₂
- and
- H₂O
- .

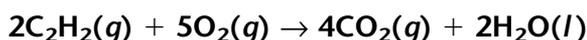
SECTION 2 continued

7. For the following four reactions, identify the type, predict the products (make sure formulas are correct), and balance the equations:



8. Acetylene gas, C_2H_2 , is burned to provide the high temperature needed in welding.

a. Write the balanced chemical equation for the combustion of C_2H_2 in oxygen.



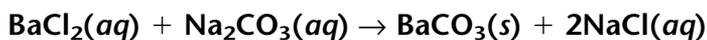
2.0 mol

b. If 1.0 mol of C_2H_2 is burned, how many moles of CO_2 are formed?

2.5 mol

c. If 1.0 mol of C_2H_2 is burned how many moles of oxygen gas are consumed?

9. a. Write the balanced chemical equation for the reaction that occurs when solutions of barium chloride and sodium carbonate are mixed. Refer to **Table 1** on page 437 in **Chapter 13** for solubility.



b. To which of the five basic types of reactions does this reaction belong?

double-displacement

10. For the commercial preparation of aluminum metal, the metal is extracted by electrolysis from alumina, Al_2O_3 . Write the balanced chemical equation for the electrolysis of molten Al_2O_3 .



CHAPTER 8 REVIEW*Chemical Equations and Reactions***SECTION 3****SHORT ANSWER** Answer the following questions in the space provided.

1. List four metals that will *not* replace hydrogen in an acid.

Choose from Cu, Ag, Au, Pt, Sb, Bi, and Hg.

2. Consider the metals iron and silver, both listed in **Table 3** on page 286 of the text. Which one readily forms an oxide in nature, and which one does not?

Fe forms an oxide in nature, and Ag does not, because it is much less active.

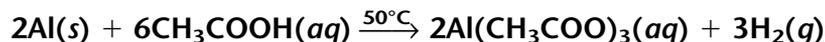
3. In each of the following pairs, identify the more active element.

F₂ a. F₂ and I₂

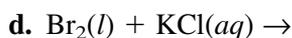
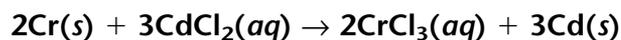
K b. Mn and K

H c. Cu and H

4. Use the information in **Table 3** on page 286 of the text to predict whether each of the following reactions will occur. For each reaction that will occur, complete the chemical equation by writing in the products formed and balancing the final equation.



no reaction



no reaction

SECTION 3 continued

5. Very active metals will react with water to release hydrogen gas and form hydroxides.

a. Complete, and then balance, the equation for the reaction of Ca(s) with water.



b. The reaction of rubidium, Rb, with water is faster and more violent than the reaction of Na with water. Use the atomic structure and radius of each metal to account for this difference.

Both are alkali metals and readily form a stable 1+ ion by ejecting an s¹ electron.

Rb has a larger radius than Na and holds its electron less tightly, making it more reactive.

6. Gold, Au, is often used in jewelry. How does the relative activity of Au relate to its use in jewelry?

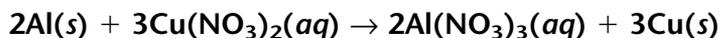
Gold has a low reactivity and therefore does not corrode over time.

7. Explain how to use an activity series to predict the outcome of a single-displacement reaction.

In single-displacement reactions, if the activity of the free element is greater than that of the element in the compound, the reaction will take place.

8. Aluminum is above copper in the activity series. Will aluminum metal react with copper(II) nitrate, Cu(NO₃)₂, to form aluminum nitrate, Al(NO₃)₃? If so, write the balanced chemical equation for the reaction.

Yes; because aluminum is above copper in the activity series, aluminum metal will replace copper in copper(II) nitrate.



CHAPTER 8 REVIEW*Chemical Equations and Reactions***MIXED REVIEW****SHORT ANSWER** Answer the following questions in the space provided.

1. b A balanced chemical equation represents all the following *except*
- (a) experimentally established facts.
 - (b) the mechanism by which reactants combine to form products.
 - (c) identities of reactants and products in a chemical reaction.
 - (d) relative quantities of reactants and products in a chemical reaction.
2. d According to the law of conservation of mass, the total mass of the reacting substances is
- (a) always more than the total mass of the products.
 - (b) always less than the total mass of the products.
 - (c) sometimes more and sometimes less than the total mass of the products.
 - (d) always equal to the total mass of the products.
3. Predict whether each of the following chemical reactions will occur. For each reaction that will occur, identify the reaction type and complete the chemical equation by writing in the products formed and balancing the final equation. General solubility rules are in **Table 1** on page 437 of the text.
- a. $\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{Na}_3\text{PO}_4(\text{aq}) \rightarrow$
double-displacement; $3\text{Ba}(\text{NO}_3)_2(\text{aq}) + 2\text{Na}_3\text{PO}_4(\text{aq}) \rightarrow$
 $\text{Ba}_3(\text{PO}_4)_2(\text{s}) + 6\text{NaNO}_3(\text{aq})$
- b. $\text{Al}(\text{s}) + \text{O}_2(\text{g}) \rightarrow$
synthesis; $4\text{Al}(\text{s}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{Al}_2\text{O}_3(\text{s})$
- c. $\text{I}_2(\text{s}) + \text{NaBr}(\text{aq}) \rightarrow$
no reaction
- d. $\text{C}_3\text{H}_4(\text{g}) + \text{O}_2(\text{g}) \rightarrow$
combustion; $\text{C}_3\text{H}_4(\text{g}) + 4\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$

MIXED REVIEW continued

- e. electrolysis of molten potassium chloride



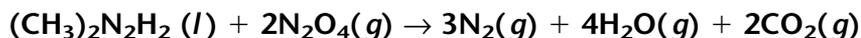
4. Some small rockets are powered by the reaction represented by the following unbalanced equation:



- a. Translate this chemical equation into a sentence. (Hint: The name for $(\text{CH}_3)_2\text{N}_2\text{H}_2$ is dimethylhydrazine.)

When liquid dimethylhydrazine is mixed with dinitrogen tetroxide gas, the products are nitrogen gas, water vapor, and gaseous carbon dioxide, along with energy in the form of heat.

- b. Balance the formula equation.



5. In the laboratory, you are given two small chips of each of the unknown metals X, Y, and Z, along with dropper bottles containing solutions of $\text{XCl}_2(aq)$ and $\text{ZCl}_2(aq)$. Describe an experimental strategy you could use to determine the relative activities of X, Y, and Z.

Wording and strategies will vary. First, place one chip of Y into $\text{XCl}_2(aq)$ and another into $\text{ZCl}_2(aq)$. If Y reacts with one solution but not the other, the activity series can be established. If Y replaces X but not Z, the series is $\text{Z} > \text{Y} > \text{X}$. If Y replaces Z but not X, the series is $\text{X} > \text{Y} > \text{Z}$. If Y reacts with neither solution, Y is at the bottom of the series. Next, put one chip of X into $\text{ZCl}_2(aq)$. If it reacts, the series is $\text{X} > \text{Z} > \text{Y}$. If it does not react, the series is $\text{Z} > \text{X} > \text{Y}$. If Y reacts with both solutions, Y is the most reactive. Last, put a chip of X into $\text{ZCl}_2(aq)$. If it reacts, the series is $\text{Y} > \text{X} > \text{Z}$. If it does not react, the series is $\text{Y} > \text{Z} > \text{X}$.

6. List the observations that would indicate that a reaction had occurred.

Signs of a reaction include generation of energy as heat or light, formation of a precipitate, formation of a gas, and change in color.
